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optical switch in a last column of the matrix requires controlling only one of the plurality of switching means of only one of the plurality of polarization control optical switches in the matrix.

REMARKS

In the Office Action mailed on August 27, 2002, claims 32-38 were rejected under 35 U.S.C. § 112, second paragraph, for indefiniteness; claims 32-38 were rejected under 35 U.S.C. § 102(b) as being anticipated by Healey et al. (U.S. Patent No. 5,013,140) ("Healey"); claims 32-38 were rejected under 35 U.S.C. § 102(b) as being anticipated by Yamamoto et al. (U.S. Patent No. 5,162,944) ("Yamamoto"); claims 32-38 were rejected under 35 U.S.C. § 102(b) as being anticipated by DeJule et al. (U.S. Patent No. 5,317,445) ("DeJule"); and claims 23-31 were allowed. The foregoing rejections are respectfully traversed.

Claims 23-38 are pending in the subject application, of which claims 23, 32, 33, 35, 36, and 38 are independent. Claims 32, 33, 35, 36, and 38 are amended herein. Care has been exercised to avoid the introduction of new matter. A Version With Markings To Show Changes Made to the specification and amended claims is included herewith.

Entry of Amendment After Final Rejection:

The Applicant respectfully asserts that the amendments presented herein require only a cursory review by the Examiner, and respectfully requests that the Examiner enter such amendments.

Foreign Priority:

It is noted that the Examiner has acknowledged the Applicant's claim for priority under 35 U.S.C. § 119 and the receipt of a certified copy of the priority application in the parent case, in an Office Action mailed on March 7, 1996 (U.S. serial number 08/200,657). The Applicant respectfully requests that the Examiner acknowledge the same in the subject application.

Rejections Under 35 U.S.C. § 112:

Claims 32, 33, and 35 are amended herein to recite “a plurality of” switching elements and controlling “only one of the plurality of” switching elements. Claims 36 and 38 are amended herein to recite “a plurality of” switching means and controlling “only one of the plurality of” switching means. Claims 34 and 37 depend from claims 33 and 36, respectively.

The Applicants note that only one switching element/means needs to be controlled per Figure 2 and page 12, line 22 through page 14, line 25 of the Specification. It appears that the Examiner misunderstands the present invention, and thinks that the invention relies upon the control of the polarization control optical switches, as opposed to the polarization control elements. Each of the polarization control elements has an on and off state, and when controlling only one polarization control element, only one is in the bar state, and the rest are in the cross state, according to Figure 2.

The Applicants respectfully request that the Examiner withdraw the rejections.

Rejections Under 35 U.S.C. § 102(b):

Claims 32, 33, and 35 recite controlling “only one of the plurality of” switching elements. Claims 36 and 38 recite controlling “only one of the plurality of” switching means. Claims 34 and 37 depend from claims 33 and 36, respectively.

In the Examiner's response to our arguments in item 2, on page 2 of the Office Action, the Examiner stated that each of the cited references discloses controlling polarization control optical switches.

However, in the present invention, as illustrated in Figure 1, a polarization optical control switch comprises a plurality of polarization optical control switches 1. Each of the plurality of polarization optical control switches 1 comprises a plurality of polarization control elements 1b. In the present invention, control of only one of the plurality of polarization control elements 1b is necessary, whereas in the cited references, control of multiple polarization control elements (by controlling an entire polarization optical control switch) is required.

Clearly, claims 32-38 are patentably distinguishable over the cited references. The Applicants respectfully request that the Examiner withdraw the rejections thereto.

Allowable Subject Matter:

Claims 23-31 have been allowed by the Examiner.

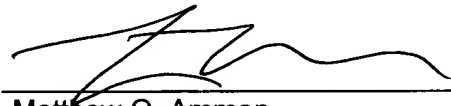
Withdrawal of the foregoing rejections is respectfully requested.

There being no further objections or rejections, it is submitted that the application is in condition for allowance, which action is courteously requested. Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters. If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

STAAS & HALSEY LLP

Date: 11-15-2002

By: 
Matthew Q. Ammon
Registration No. 50,346

700 Eleventh Street, NW, Suite 500
Washington, D.C. 20001
(202) 434-1500

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Please AMEND claims 32, 33, 35, 36, and 38. The remaining claims are reprinted, as a convenience to the Examiner, as they presently stand before the U.S. Patent and Trademark Office.

23. (ONCE AMENDED) A polarization control optical space switch comprising:
a plurality of polarization control optical switches cascaded together;
wherein each polarization control optical switch comprises:
a first polarization controller that is capable of changing the polarization of light incident thereon by one of applying voltage thereto and not applying voltage thereto;
a first element to change the optical path of light from said first polarization controller;
a delay plate to change the polarization of light incident thereon from said first element; and
a second element to change the optical path of light from said delay plate; and
a final polarization control optical switch comprising:
a second polarization controller that is capable of changing the polarization of light incident thereon by one of applying voltage thereto and not applying voltage thereto; and
a third element to change the optical path of light from said second polarization controller,
wherein said polarization control optical space switch has a plurality of inputs and the same number of outputs, and
wherein switching light from one input to one output requires controlling only one of said first, second and third elements.

24. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein said delay plate includes segments that do not delay light incident thereon.

25. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein said first element to change the optical path of light from said first polarization

controller and the second element to change the optical path of light from said delay plate only change the optical path of p-polarized light.

26. (TWICE AMENDED) A polarization control optical space switch according to claim 23, wherein said first element to change the optical path of light from said polarization controller and the second element to change the optical path of light from said delay plate only change the optical path of s-polarized light.

27. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein said first element to change the optical path of light from said first polarization controller changes the optical path by moving light incident at the i -th input thereto to one of the $(i-1)$ th and $(i+1)$ th output.

28. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein said second element to change the optical path of light from said delay plate changes the optical path by moving light incident at an i -th input thereto to one of an $(i-1)$ th and an $(i+1)$ th output.

29. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein said first element to change the optical path of light from said first polarization controller is a downward polarizing beam splitter, which reflects incident light with a predetermined polarization input on the i -th input to the $(i+1)$ th output.

30. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein said second element to change the optical path of light from said delay plate is an upward polarizing beam splitter, which reflects incident light with a predetermined polarization input on an i -th input to an $(i-1)$ th output.

31. (ONCE AMENDED) A polarization control optical space switch according to claim 23, wherein the first element to change the optical path of light from said first polarization controller is constructed from a polarizing beam splitter array consisting of a combination of polarizing beam splitters.

32. (TWICE AMENDED) A polarization control optical space switch comprising:
a plurality of polarization control optical switches connected together between a plurality of inputs and a corresponding plurality of outputs, each of said plurality of polarization control optical switches comprising:
a polarization controller changing the polarization of the light incident thereon by one of applying voltage thereto and not applying voltage thereto; and
a plurality of switching elements changing the optical path of the light from said polarization controller,
wherein switching light from one of said plurality of inputs to one of said plurality of outputs requires controlling only one of the plurality of switching elements of only one of the plurality of polarization control optical switches.

33. (TWICE AMENDED) A polarization control optical space switch comprising:
polarization control optical switches, each having a plurality of inputs and a plurality of outputs and connected together as a matrix defined by columns and rows, each of the polarization control optical switches comprising:
a polarization controller changing the polarization of light received by a respective input of the respective polarization control optical switch and incident on the polarization controller by one of applying voltage thereto and not applying voltage thereto, and
a plurality of switching elements selectively outputting the polarization changed light to a respective output of the respective polarization control optical switch,
wherein switching light from a respective input of a respective polarization control optical switch in a first column of the matrix to a respective output of a respective polarization control optical switch in a last column of the matrix requires controlling only one of the plurality of switching elements of only one of the plurality of polarization control optical switches in the matrix.

34. A polarization control optical space switch as in claim 33, wherein the matrix is an $N \times N$ matrix.

35. (TWICE AMENDED) An apparatus comprising:
an optical space switch comprising:

polarization control optical switches, each having a plurality of inputs and a plurality of outputs and connected together as a matrix defined by columns and rows, each of the polarization control optical switches comprising:

a polarization controller changing the polarization of light received by a respective input of the respective polarization control optical switch and incident on the polarization controller by one of applying voltage thereto and not applying voltage thereto, and

a plurality of switching elements selectively outputting the polarization changed light to a respective output of the respective polarization control optical switch,

wherein switching light from a respective input of a respective polarization control optical switch in a first column of the matrix to a respective output of a respective polarization control optical switch in a last column of the matrix requires controlling only one of the plurality of switching elements of only one of the plurality of polarization control optical switches in the matrix.

36. (TWICE AMENDED) A polarization control optical space switch comprising:

polarization control optical switches, each having a plurality of inputs and a plurality of outputs and connected together as a matrix defined by columns and rows, each of the polarization control optical switches comprising:

a polarization controlling means for changing the polarization of light received by a respective input of the respective polarization control optical switch and incident on the polarization controlling means by one of applying voltage thereto and not applying voltage thereto, and

a plurality of switching means for selectively outputting the polarization changed light to a respective output of the respective polarization control optical switch,

wherein switching light from a respective input of a respective polarization control optical switch in a first column of the matrix to a respective output of a respective polarization control optical switch in a last column of the matrix requires controlling only one of the plurality of switching means of only one of the plurality of polarization control optical switches in the matrix.

37. A polarization control optical space switch as in claim 36, wherein the matrix is an $N \times N$ matrix.

38. (TWICE AMENDED) An apparatus comprising:

an optical space switch comprising:

polarization control optical switches, each having a plurality of inputs and a plurality of outputs and connected together as a matrix defined by columns and rows, each of the polarization control optical switches comprising:

a polarization controlling means for changing the polarization of light received by a respective input of the respective polarization control optical switch and incident on the polarization controlling means by one of applying voltage thereto and not applying voltage thereto, and

a plurality of switching means for selectively outputting the polarization changed light to a respective output of the respective polarization control optical switch,

wherein switching light from a respective input of a respective polarization control optical switch in a first column of the matrix to a respective output of a respective polarization control optical switch in a last column of the matrix requires controlling only one of the plurality of switching means of only one of the plurality of polarization control optical switches in the matrix.